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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SHUNPEI YAMAZAKI and SATOSHI TERAMOTO

Appeal 2009-011881
Application 08/994,038
Technology Center 2800

Before JAMES D. THOMAS, MAHSHID D. SAADAT,
and CARL W. WHITEHEAD, JR., *Administrative Patent Judges*.

SAADAT, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

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[1] The two month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304 or for filing a request for rehearing as recited in 37 C.F.R. § 41.52, begins to run from the "MAIL DATE" (paper delivery mode) or the "NOTIFICATION DATE" (electronic delivery mode) shown on the PTOL-90A cover letter attached to this decision.

Appellants appeal under 35 U.S.C. § 134(a) from a final rejection of claims 2, 6, 11, 12, 14, and 16-26. Claims 1, 3-5, and 13 have been canceled and claims 7-10 and 15 have been withdrawn from consideration. Attendance at the requested oral hearing for this appeal was waived. We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

STATEMENT OF THE CASE

Appellants' invention is directed to a charge transfer semiconductor device comprising charge accumulating means in which charge transfer means transfer the charges accumulated in the charge accumulating means (Spec. 3:2-7). According to Appellants, the charge transfer device includes a crystalline silicon film having rod-like or columnar crystal bodies extending in a particular direction that coincide or approximately coincide with a charge transfer direction of the charge transfer means (Spec. 3:7-9).

Claim 2 is representative of the claims on appeal and reads as follows:

> 2. A semiconductor device comprising:
>
> a plurality of photodiodes being formed in a matrix on an insulating surface;
>
> a plurality of vertical charge coupled devices on the insulating surface, said vertical charge coupled devices being connected with the plurality of photodiodes;
>
> at least a horizontal charge coupled device on the insulating surface, said horizontal charge coupled device being connected with the vertical charge coupled devices,
>
> wherein at least one of the vertical and horizontal charge coupled devices comprises a crystalline semiconductor film having a plurality of crystals extending in a crystal growth direction,

> wherein a crystal structure of the crystalline semiconductor film in the crystal growth direction is continuous so that a charge moving is not restricted by a grain boundary,
>
> wherein at least one of the vertical and horizontal charge coupled devices that has the crystalline semiconductor film is arranged such that a charge transfer direction of the at least one of the vertical and horizontal charge coupled devices is coincident with the crystal growth direction.

Claims 2, 6, 11-14, and 16-26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Inoue (U.S. Patent No. 5,873,003, issued Feb. 16, 1999) in view of Okada (U.S. Patent No. 5,582,640, issued Dec. 10, 1996).

We make reference to the Briefs (Appeal Brief filed July 16, 2007, and supplemented December 17, 2007, and Reply Brief filed March 23, 2009) and the Answer (mailed January 22, 2009) for Appellants' and the Examiner's arguments.

ISSUE

The Examiner relies on Inoue for disclosing all the elements of claim 2 except for the feature "wherein at least one of the vertical and horizontal charge coupled devices that has the crystalline semiconductor film is arranged such that a charge transfer direction of the at least one of the vertical and horizontal charge coupled devices is coincident with the crystal growth direction," for which the Examiner relies on Okada (Ans. 4-5).

Appellants contend (App. Br. 6-7) that Inoue does not disclose or suggest a (vertical or horizontal) charge coupled device (CCD) that "comprises a crystalline semiconductor film having a plurality of crystals extending in a crystal growth direction." Appellants further argue (App. Br.

7-8) that the discussion of the film 1753 in Inoue, which is characterized by the Examiner as the claimed crystalline semiconductor film having a plurality of crystals, provides no reference to a crystal growth direction. With respect to Okada, Appellants assert (App. Br. 8-9) that the reference provides no teachings pertinent to the recited CCD, or how the crystal growth of Okada relates to the claimed CCD and the charge transfer direction.

Therefore, the arguments made by Appellants present us with the following issue:

Did the Examiner err in rejecting claim 2 under 35 U.S.C. § 103(a) by combining Inoue and Okada to specifically teach the claimed "wherein at least one of the vertical and horizontal charge coupled devices that has the crystalline semiconductor film is arranged such that a charge transfer direction of the at least one of the vertical and horizontal charge coupled devices is coincident with the crystal growth direction?"

FINDINGS OF FACT

The following findings of fact (FF) are relevant to the issue involved in the appeal.

Inoue

1. Inoue relates to forming thin film transistors (TFT) used in display devices and CCDs. (Col. 1, ll. 13-22.)

2. Inoue describes manufacturing methods for a TFT, as shown in Figure 48, wherein the TFT structure is composed of a channel formed of polysilicon, single crystal in which polysilicon is recrystallized, or amorphous silicon. (Col. 26, l. 64 – col. 27, l. 13.)

3. As shown in Figure 50, Inoue describes the cross section of a photoelectric converter composed of a CCD.

Okada

4. Figure 84(d) of Okada is reproduced below:

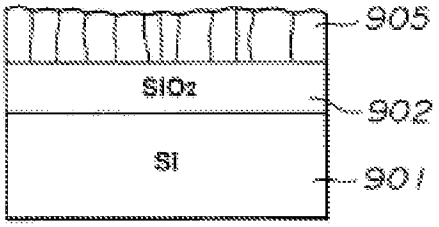

Figure 84(d) of Okada shows the grains of the polycrystalline silicon 905 formed by using granular single crystalline silicon 904 as the "seed." *See* col. 61, ll. 35-39.

5. Figure 84(g) of Okada is reproduced below:

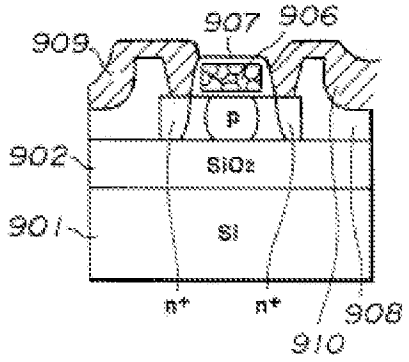

Figure 84(g) of Okada shows source and drain regions in the island formed by etching the polycrystalline film 905. *See* col. 62, ll. 15-22.

6. Okada discloses that the device characteristics become more stable when grain boundaries are present in the channel region. (Col. 62, ll. 34-47.)

PRINCIPLES OF LAW

The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art. *See In re Kahn*, 441 F.3d 977, 987-88 (Fed. Cir. 2006); *In re Young*, 927 F.2d 588, 591 (Fed. Cir. 1991); *In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

> Section 103 forbids issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007).

ANALYSIS

We do not agree with the Examiner's assertion (Ans. 9) that Inoue's polycrystalline silicon layer meets the claimed subject matter because all polycrystalline materials grow in a vertical and a horizontal direction and because Appellants have not disclosed why charges moving along the grain boundary of the crystal are different from the prior art. The Examiner's position disregards the requirements of the claims specifying a particular alignment of the crystalline grains such that the movement of charges in not restricted by a grain boundary. *See* claim 2. We further find that the Examiner's discussion (Ans. 10) that the claimed limitations are obvious features of any semiconductor material also misses the point. In that regard, while charges may move in directions that happen to be in the crystal growth direction for a fraction of the distance they cover, claim 2 requires that at least one of the vertical and horizontal CCDs has crystalline structure where

the crystal growth direction coincides with the charge transfer direction of the device.

As argued by Appellants (Reply Br. 2), the crystal growth direction is significant in determining whether Inoue and Okada disclose the claimed limitation. Specifically, Appellants assert (*id.*) that, as shown in Figures 84(a)-84(g) of Okada, the crystalline semiconductor film 905 has a vertical crystal growth direction, whereas the charges move across the transistor channel in a horizontal direction. We agree with Appellants and find that Okada does not require the crystal growth direction to coincide with the charge transfer direction (FF 4-5). In fact, Okada invites the presence of grain boundaries in the channel region in order to stabilize the device characteristics (FF 6).

Therefore, because the disclosure of Inoue is limited to formation of a TFT used in CCDs wherein the TFT structure is composed of polycrystalline silicon (FF 1-3), and the crystalline growth direction of Okada does not coincide with the charge transfer direction, we agree with Appellants' position that the combination of Inoue and Okada does not render obvious the subject matter of claim 2, nor of claims 6, 11, 12, 14, and 16-26, which either include similar limitations or are dependent thereon.

CONCLUSION

On the record before us and in view of the analysis above, we find that the Examiner erred in rejecting claim 2 under 35 U.S.C. § 103(a) by combining Inoue and Okada to specifically teach the claimed "wherein at least one of the vertical and horizontal charge coupled devices that has the crystalline semiconductor film is arranged such that a charge transfer

direction of the at least one of the vertical and horizontal charge coupled devices is coincident with the crystal growth direction." Therefore, the 35 U.S.C. § 103 rejection of claims 2, 6, 11, 12, 14, and 16-26 over Inoue and Okada cannot be sustained.

ORDER

The decision of the Examiner rejecting claims 2, 6, 11, 12, 14, and 16-26 is reversed.

REVERSED

babc

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